Thermal Conductivity of Fluids

Michel Johnson [C, S]
Institute for Research in Materials, Dalhousie University, Halfiax, Nova Scotia, Canada
michel.johnson@dal.ca

Mary Anne White
Dalhousie University, Department of Chemistry, Halfiax, Nova Scotia, Canada

Thermal conductivity measurements of solids have long been established. Metallic materials require needle or bar geometries in order to have an appreciable temperature gradient across the sample. Powders, on the other hand, can have many consolidation techniques including cold pressing, cold pressing / sintering, spark plasma sintering, hot-pressing, or even be measured as-is. Useful sample geometry for thermal property determination can vary considerably depending on the material's thermal conductivity, but generally a regular cuboid produces good results. Measuring the thermal conductivity of a fluid is not trivial since it requires a containment vessel. Considerations include that the containment vessel be small, stable in vacuum, and robust enough to be handled. It is also necessary to have a method to load samples, and most importantly, the containment vessel should have a low thermal conductivity. Current efforts are aimed at producing a "hot-plate" type measurement stage for fluids using the Thermal Transport Option of a Physical Property Measurement System (PPMS), a commercial instrument from Quantum Design. The ultimate goal would be to have a stage capable of determining the thermal conductivity of fluids over a temperature range as large as 2 to 400 K.